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Structural Analysis with Visualization Elements as a Factor in the Development of the Commercial Real Estate Market

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Abstract. This paper presents a universal method of structural analysis of the commercial real estate market with a detailed step-by-step analysis. For example, the analysis was carried out based on commercial real estate in the city of Ekaterinburg. The method is unique in creating visual content that is a map of typical territorial zones of the city of Ekaterinburg. The analysis method also includes the classical structuring of information in the form of tables and diagrams based on real offers for the sale and lease of real estate. The authors formulated forecasts for each segment of the commercial real estate market. Based on this work, anyone can conduct a similar analysis in their city or use it as a base for creating a visualization of the territory according to the zoning given in the work. Having information structured in this way will make it easier to evaluate real estate objects by their real environment.

1. Introduction

The real estate market is affected by macroeconomic factors and is therefore constantly being transformed. Market trends are fleeting and changing here and now.

In this article, the authors reviewed trends in the commercial real estate segment in the capital of the Urals, Ekaterinburg (Russia). Today, the city of Yekaterinburg is included in the rating of the five largest cities in the Russian Federation. Developers are actively developing the territory of both point objects and entire residential areas. It should be noted that in recent years, the city has implemented one of the largest projects in Russia for the development of the territory – the Academic district [1].

So today there is a demand for cheap commercial real estate of economy class on the outskirts of the city and in areas close to the center. This is because small businesses are taking an increasing share of the market [2].

According to the analytical Department of the company "a Priori-real Estate", the average cost of one square meter of commercial real estate in Ekaterinburg in the summer of 2020 is a little more than fifty thousand rubles for large objects. The drop in the cost for six months is 2.7 % [3].

To understand the flow of changing information, both specialists and ordinary people can help visual content on the appearance of the territory.

When developing the project, the authors asked the question: What benefits will our work bring to people? Compared to other studies in the field of commercial real estate valuation, the presented work is easier to read visual content, since the analysis is not only dry graphs and tables, but also a detailed map that clearly shows the environment of the object. Also, the developed method is universal, since such an analysis can be carried out based on any city.



2. Problem statement and relevance

The main goal of the work was to create a visualization of the external appearance of the city territory with subsequent analysis of extensive and intensive indicators of existing offers on the commercial real estate market on the example of the city of Ekaterinburg. This approach allows you to qualitatively analyze the economic state of the commercial real estate market, as well as simplify the procedure for self-assessment of the location of the object, its price, and quality indicators.

The object of research is commercial real estate. The subject of the research is a structural analysis of the commercial real estate market based on visual content and generated tables.

The authors developed a method of structural analysis of the commercial real estate market. You can use it for any city. The authors give an example of how this technique works in their hometown. The methodology includes drawing up a map of typical territorial zones of the city of Ekaterinburg, compiling a detailed sample (database) of market data on the sale and lease of commercial real estate, and extensive analysis of segments of the commercial real estate market.

The study was conducted for the first half of 2020. This analysis is necessary to determine General and specific trends, as well as prospects for its development. They will help investors make management decisions. Fast and efficient.

During the research, the authors set themselves the following tasks:

1) Conduct territorial price zoning of the city of Ekaterinburg by selecting typical territorial zones of the city, based on the analysis of the city's master plan, land use and development rules, and established economic zones and trade corridors.

2) Create a database of market data for the sale and lease of commercial real estate in the city of Yekaterinburg in accordance with the proposed market segmentation;

3) Analyze the obtained databases and form meaningful and up-to-date forecasts for the development of the commercial real estate market in Ekaterinburg.

The relevance of this work lies in the uniqueness of the study in the unstable conditions of the real estate market. It should be noted that the information obtained from the study will be based on the latest data, which will differ from pre-pandemic indicators.

The scientific significance lies in the novelty of the research conducted on the allocation of typical territorial zones of the city, based on the analysis of the city's master plan, land use, and development rules, and formed economic zones and trade corridors.

This study is relevant to the field of commercial real estate valuation. The authors created a map of typical territorial zones using the tools in The Yandex-maps constructor. Thus, the territory was divided into zones. The map created by the authors can be used for visual assessment of the territorial environment of commercial objects. It makes it much easier to determine the level of the area and the class of the room. Structured data on commercial real estate segments will help in comparative analysis for commercial real estate objects. The convenient format of the data provided in the form of tables and diagrams, as well as a working map with territorial zones, will allow owners to independently assess the level and approximate price of the object. It will also clearly show investors the attractiveness of the object's location.

The target audience for the project is appraisers, business representatives, and investors.

The research methods are: creating visual content, structural analysis of the commercial real estate market.

3. Literature review

This section summarizes the results of a study of the General state of the commercial real estate market by segment in the city of Ekaterinburg. Thus, office, retail and industrial and warehouse real estate will be considered.

Office real estate is currently less susceptible to short-term impact. However, attracts the attention of the existing rotation. As a result, it is assumed that this market can change the most qualitatively: a decrease in occupied space due to a drop in orders and a new look at the usual dense Seating of office employees, as well as the experience of working remotely [4,5].

Main trends in the office real estate market in Yekaterinburg for the first half of 2020 [6]:

- 1) A shift of business activity within the Central district to the Central-southern and Central-Western parts;
- 2) Active development of the banks of the Iset river increased interest of developers in the VIZ and bus Station districts;
- 3) Increasing the importance of Management companies in the operation of business centers;
- 4) Reorientation of the business center to the "one object – one owner" format»;
- 5) The recent trend of business activity flowing out of the Center has been suspended, and the factor of territorial accessibility and infrastructure development is becoming more important;
- 6) Reduction of rental rates in the business center of the city Ekaterinburg is not expected. At the moment, there is an increase in prices for renting and selling office real estate;
- 7) Empty areas are expected to increase;
- 8) According to forecasts of Andrey Braude, Deputy General Director of RED Management Company LLC, the loss of developers in Yekaterinburg, the annual revenue will be 20-30%. in the near future, the recovery period after the crisis due to the coronavirus pandemic will begin.

As for retail real estate, experts note that in 2019-2020, it is expected to open more than a million square meters of new space. However, some analysts believe that the future belongs to small district-scale shopping centers.

Main trends in the retail real estate market in Yekaterinburg for the first half of 2020 [7,8]:

- 1) Gradual obsolescence of old formats and degradation of street retail on some streets, for example, Sverdlov;
- 2) Increasing the importance of Management companies in the operation of shopping centers;
- 3) A slight increase in the level of vacant space in retail real estate, as well as the volume of new space commissioning;
- 4) In connection with the crisis of 2020, owners of commercial real estate are selling their property;
- 5) No reduction in rental rates is expected soon, and prices are rising on the market;
- 6) To date, Yekaterinburg is actively building residential blocks, which is why there are new district shopping centers.

The authors note that in the field of warehouse real estate, demand remains stable. According to Andrey Tolchin, Director of the ESTATE development company, there are more than 1 million "squares" of modern warehouse space in the agglomeration, but there is almost no free space [9].

Main trends in the market of industrial and warehouse real estate in Ekaterinburg for the first half of 2020 [10,11]:

- 1) Active development of former industrial sites for residential and business development;
- 2) Commercial warehouses will take up to 60% of the total input volume;
- 3) In 2020, demand will depend on the actual supply of finished and new construction, as well as the dynamics of rental rates;
- 4) The upward trend in rental rates will continue in 2020, despite more active completion of warehouse facilities.

4. Practical part of the study

To conduct a detailed structural analysis, the authors propose to proceed in the following order. This method can be used for any city, but the authors of the study analyzed their hometown – Ekaterinburg.

Stage 1: Creating the Appearance of the City Territory

As a result of the research, the authors created a map in The Yandex-maps constructor using the Polygons tool for typical territorial zones of the city of Ekaterinburg (see Fig. 1). The map shows such areas as: green areas, residential housing, highways, residential neighborhoods, administrative centers, suburbs and industrial zones. The historical center of the city and the borders of Ekaterinburg were also highlighted. Each zone was assigned its number and name. In the future, the map was used to determine the location of a commercial property by the selected zones. The map clearly shows how

the areas of residential housing and residential areas are dispersed relative to green areas, as well as suburbs and industrial zones.

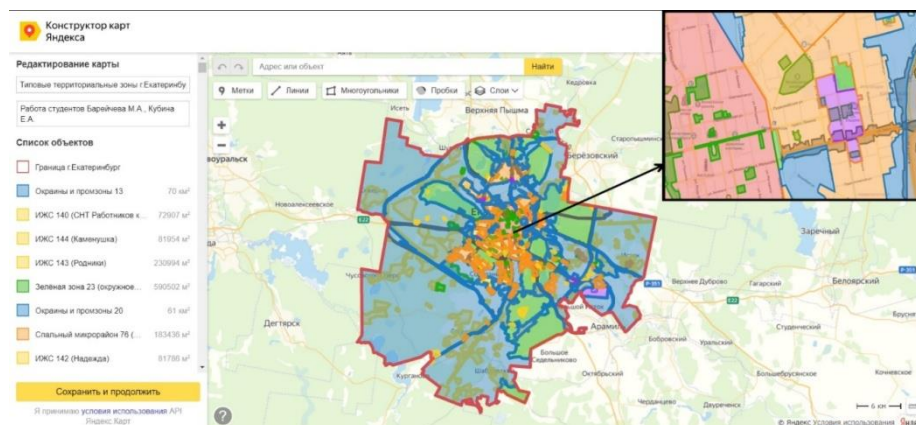


Figure 1. Map of typical territorial zones of the city of Ekaterinburg.

Stage 2: Creating a Database of Market Data for the Sale and Lease of Commercial Real Estate

The database was formed by the proposed market segmentation (see Fig. 2). The selection of commercial properties to form the database was based on existing offers on the real estate market. Additionally, free-use objects were considered. The total number of offers presented in the sample is more than 350 objects, which allowed us to structure the obtained data qualitatively.

[illegible]

Figure 2. Market database for the sale and lease of commercial real estate in the city of Ekaterinburg.

All properties were described using the following criteria: segment, class, transaction type, an ad link, price signs, time signs (number of views, expert exposure dates, ad date), location signs, physical signs (total area, building type, layout, year of construction, materials, access, etc.).

Stage 3: Analysis of a Sample of Office Real Estate

To highlight many of the research indicators, the popular platform for selling and renting real estate in the city of Ekaterinburg "Cian" was used [12]. the leader in the total offer of high-class office real estate was identified as MKR. Center (45.6%). For other districts, the main offer of office real estate for sale and rent is concentrated in Kirovsky, Leninsky, Verkh-Isetsy, and Oktyabrsky districts. This is where the largest offer of office real estate sales is located, and the average rate varies greatly regardless of the class. The authors also looked at the outskirts of the city, where class a, B+, and B office properties are found primarily in new neighborhoods.

Next, the authors began to determine the average value of the sale or lease rate depending on the class of real estate based on the previously compiled database of market data on the sale and lease of commercial real estate. Table 1 shows the dependence of the rental and purchase rates of office real estate depending on the class of the object in the city. Ekaterinburg is based on the authors' research.

Table 1. Average real values of office real estate sales and rental prices.

Indicator	Unit of measure	Sale	Rent
Class A	RUB; RUB/month	12 500 000	64 900
Class B/B+	RUB; RUB/month	5 160 000	37 900
Class C	RUB; RUB/month	4 200 000	36 200

The authors compiled a table with the average specific values of sales and rental prices of office real estate in Ekaterinburg (Table 2). The data were obtained by deducting the average rate per sq. m. for each class of office real estate for the objects of the sample.

Table 2. Average specific values of sales and rental prices of office real estate in the city of Ekaterinburg.

Indicator	Unit of measure	Sale	Rent
Class A	RUB/sq. m; RUB per month/sq. m	135 000	900
Class B/B+	RUB/sq. m; RUB per month/sq. m	63 000	650
Class C	RUB/sq. m; RUB per month/sq. m	46 000	600

The next step in this stage, the authors analyzed the structure of the offer by city districts and made diagrams for better perception (see Fig. 3,4). The authors used the site "Cian", where they analyzed the number of offers in each district and displayed the percentage of offers in the city.

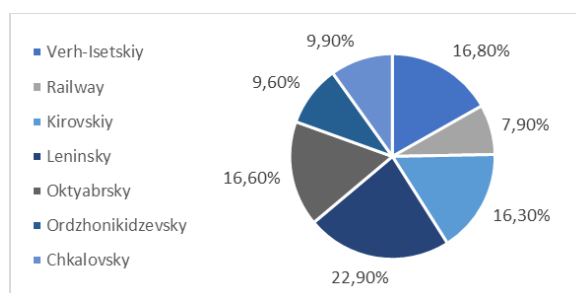


Figure 3. Diagram of the structure of the offer of sales of office real estate in the city of Ekaterinburg.

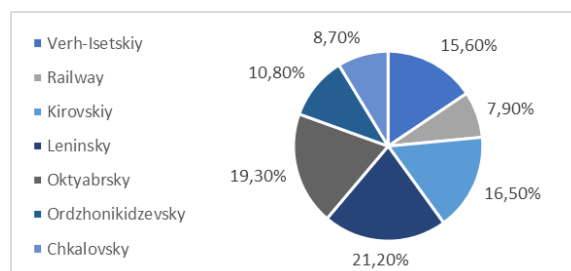


Figure 4. Diagram of the structure of the office real estate rental offer in Ekaterinburg.

The diagrams show that the largest offer of office real estate (rent and sale) is located in Leninsky and Oktyabrsky districts. The lowest offer in the Railway district.

Next, we will determine the average level of rental rates (RUB/sq. m/ month) and sales prices (RUB/sq.m) for office real estate, depending on the location in different districts of the city of Ekaterinburg (Table 3). To display the results, we used a database of market data on the sale and lease of commercial real estate in the city of Yekaterinburg. The average value formula in Excel was also used.

Table 3. Average level of real rental rates (RUB/sq. m/month) and sales prices (RUB/sq. m) for office real estate in different districts of the city of Ekaterinburg.

District	Unit of measure	Sale rate	Rental rate
Verh-Iselskiy	RUB/RUB per month	7 000 000	37 000
Railway	RUB/RUB per month	6 000 000	27 000
Kirovskiy	RUB/RUB per month	6 600 000	36 000
Leninsky	RUB/RUB per month	11 200 000	44 000
Oktyabrsky	RUB/RUB per month	7 500 000	46 000
Ordzhonikidzevsky	RUB/RUB per month	5 800 000	29 000
Chkalovsky	RUB/RUB per month	5 700 000	34 000

The final stage of the extensive analysis of office real estate was the determination of expert exposure dates (Table 4). This indicator was calculated by displaying the average value of the indicator in Excel.

Table 4. Terms of exposure by districts of the city of Ekaterinburg.

District	Unit of measure	The value of sales	The value of the rental
Verh-Iselskiy	days	340	210
Railway	days	250	220
Kirovskiy	days	280	240
Leninsky	days	400	270
Oktyabrsky	days	390	330
Ordzhonikidzevsky	days	390	210
Chkalovsky	days	250	280

Stage 4: Analysis of a Sample of Commercial Real Estate

The authors considered the specifics of retail real estate in Ekaterinburg. To begin with, the main trade corridors were identified (see Fig. 5). In this case, the shopping corridors are the streets with the largest number of street retail and major shopping centers in the city. Shopping corridors in Ekaterinburg are represented by the following streets: Lenin street; 8 March street; Malyshev street; Vayner street; Belinsky street; Krasnoarmeyskaya street.

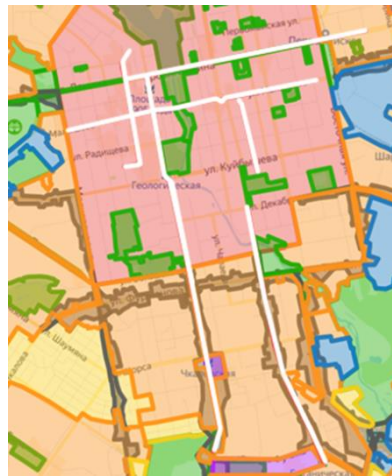


Figure 5. The Main trade corridors in the city of Ekaterinburg.

The average rental rate in retail corridors in the city Ekaterinburg is ~ 10,000 RUB/sq. m/year. This indicator was derived by searching for the average rental rate on the proposed streets. The calculations excluded the city's largest shopping center («Greenwich») since the average rental rate due to the popularity of its retail space is highly inflated (it can reach 150,000 RUB/sq. m/year).

Below are diagrams of the structure of retail real estate supply in different districts of Ekaterinburg (see Fig. 5,6). The data was obtained in a similar way to the study conducted in the office real estate section.

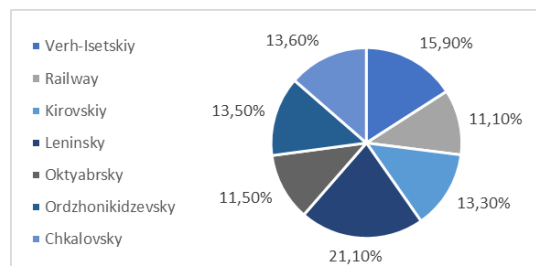


Figure 6. Diagram of the structure of the offer of sales of retail real estate in the city of Ekaterinburg.

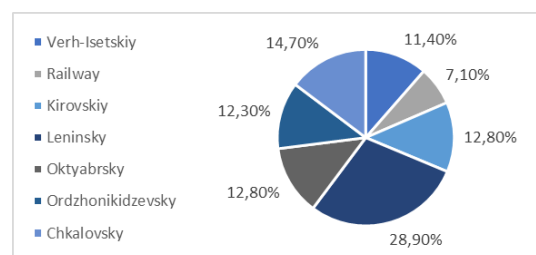


Figure 7. Diagram of the structure of the commercial real estate rental offer in Ekaterinburg.

Leninsky district has the largest share of offers for sale and lease of retail space. The lowest supply indicators were found in the Railway district.

The average level of rental rates and sales prices for retail premises in different districts of the city of Ekaterinburg by the Cian data is presented in Tables 5-6. These indicators were calculated similarly to the average level of bids for office real estate premises. The data was obtained in a similar way to the study conducted in the office real estate section.

Table 5. Average level of real rental rates and sales prices for premises in shopping centers.

District	Unit of measure		Sale rate	Rental rate
Verh-Issetskiy	RUB/RUB month	per	8 640 000	79 000
Railway	RUB/RUB month	per	9 600 000	98 000
Kirovskiy	RUB/RUB month	per	10 000 000	65 000
Leninsky	RUB/RUB month	per	13 300 000	91 000
Oktyabrsky	RUB/RUB month	per	7 990 000	58 000
Ordzhonikidzevsky	RUB/RUB month	per	8 710 000	90 000
Chkalovsky	RUB/RUB month	per	9 790 000	68 000

Table 6. Average level of specific rental rates and sales prices for premises in shopping centers.

District	Unit of measure		Sale rate	Rental rate
Verh-Issetskiy	RUB/sq. m; month/sq. m	RUB per	86 000	670
Railway	RUB/sq. m; month/sq. m	RUB per	86 000	980
Kirovskiy	RUB/sq. m; month/sq. m	RUB per	57 000	790
Leninsky	RUB/sq. m; month/sq. m	RUB per	155 000	1 300
Oktyabrsky	RUB/sq. m; month/sq. m	RUB per	48 000	850
Ordzhonikidzevsky	RUB/sq. m; month/sq. m	RUB per	68 000	440
Chkalovsky	RUB/sq. m; month/sq. m	RUB per	67 000	500

The expert terms of the exhibition are shown in Table 7. the Data were obtained similarly to the study conducted in the office real estate section.

Table 7. Terms of exposure by districts of the city of Ekaterinburg.

District	Unit of measure	The value of sales	The value of the rental
Verh-Issetskiy	days	340	260
Railway	days	370	220
Kirovskiy	days	260	230
Leninsky	days	520	380
Oktyabrsky	days	380	260
Ordzhonikidzevsky	days	270	230
Chkalovsky	days	300	330

Stage 5: Analysis of a Sample of Industrial and Warehouse Real Estate.

Next, the production and warehouse real estate of the city of Ekaterinburg was considered. For clarity, the authors have compiled a geographical structure of the supply of warehouse and industrial real estate (see Fig. 7). The data represents the structure of the offer as a percentage. Numerical indicators were calculated similarly to the previous stages and are shown in figures 8-9 for clarity. The map was created in the program of the graphic editor Sai Paint Tool.

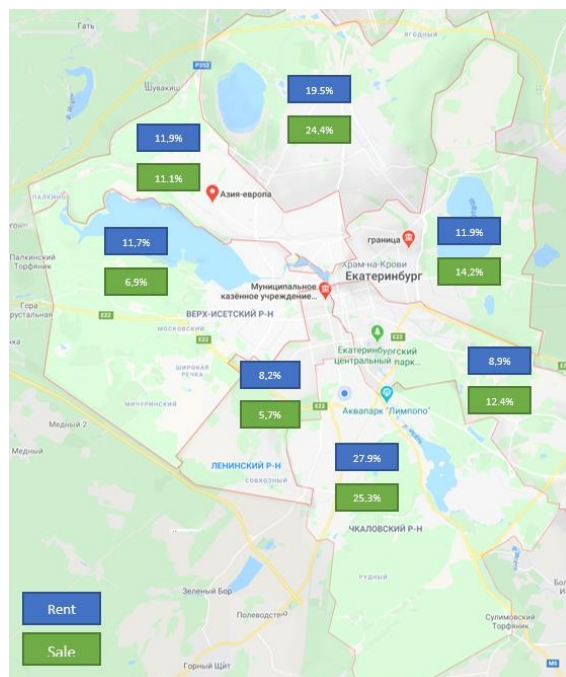


Figure 8. Geographical structure of the supply of warehouse and industrial real estate.

The largest volume of high-end warehouses is located in the area of the city's outskirts. The lack of warehouse space is expressed in the Leninsky district.

Below are diagrams of the supply structure of industrial and warehouse premises in the city of Ekaterinburg (see Fig. 8,9). The data was obtained in a similar way to the study conducted in the office real estate section.

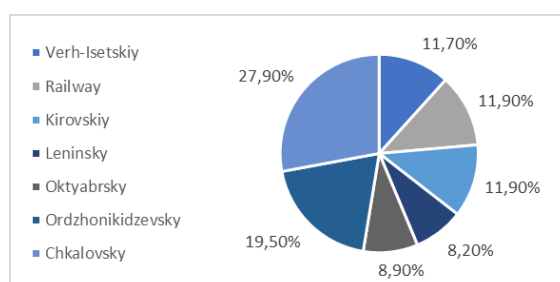


Figure 9. Diagram of the structure of the supply of sales of industrial and warehouse premises in the city of Ekaterinburg.

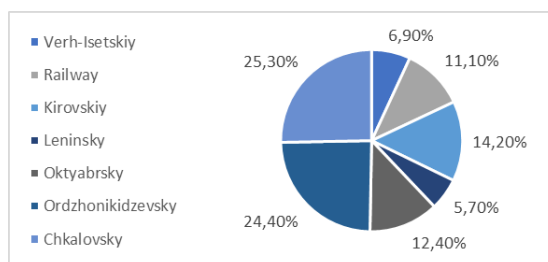


Figure 10. Diagram of the structure of the supply of lease of industrial and warehouse premises in the city of Ekaterinburg.

Chkalovsky district has the largest share of offers for the sale and lease of industrial and warehouse premises. The lowest indicators of rental and sale offers were found in the Leninsky district.

The average level of rental rates (RUB/sq. m/month) and sales prices (RUB/sq. m) for industrial and warehouse premises in different districts of the city are presented in Tables 8-9. The data was obtained in a similar way to the study conducted in the office real estate section.

Table 8. Average level of real rental rates (RUB/ sq. m/month) and sales prices (RUB/sq. m) for industrial and warehouse premises.

District	Unit of measure	Sale rate		Rental rate	
		Warehouse	Production	Warehous e	Production
Verh-Issetskiy	RUB/RUB per month	13 910 000	13 500 000	56 000	80 000
Railway	RUB/RUB per month	12 000 000	18 800 000	141 000	60 000
Kirovskiy	RUB/RUB per month	20 640 000	19 990 000	180 000	147 000
Leninsky	RUB/RUB per month	18 500 000	18 520 000	57 000	97 000
Oktyabrskiy	RUB/RUB per month	13 400 000	17 250 000	105 000	87 000
Ordzhonikidze vsky	RUB/RUB per month	53 790 000	35 000 000	145 000	140 000
Chkalovsky	RUB/RUB per month	29 000 000	17 560 000	112 000	82 300

The most popular and liquid areas are the outskirts due to the favorable logistics position and proximity to railway tracks. The most illiquid area is the Center.

Table 9. Average level of unit rental rates (RUB/sq. m/month) and sales prices (RUB/sq. m) for production and warehouse premises.

District	Unit of measure	Sale rate	Rental rate
Verh-Issetskiy	RUB/sq. m; RUB per month/sq. m	42 000	260
Railway	RUB/sq. m; RUB per month/sq. m	25 000	380
Kirovskiy	RUB/sq. m; RUB per month/sq. m	21 000	750
Leninsky	RUB/sq. m; RUB per month/sq. m	36 000	300
Oktyabrskiy	RUB/sq. m; RUB per month/sq. m	23 000	320
Ordzhonikidzevskiy	RUB/sq. m; RUB per month/sq. m	27 000	350
Chkalovsky	RUB/sq. m; RUB per month/sq. m	13 600	300

Expert exposure dates are shown in Table 10. The data was obtained in a similar way to the study conducted in the office real estate section.

Table 10. Terms of exposure by districts of the city of Ekaterinburg.

District	Unit of measure	The value of the sales	The value of the rental
Verh-Issetskiy	days	470	270
Railway	days	390	330
Kirovskiy	days	480	310
Leninsky	days	300	360
Oktyabrsky	days	430	400
Ordzhonikidzevsky	days	490	300
Chkalovsky	days	380	300

This completes the step-by-step structure of the study. You can sum up the results.

5. Conclusions

Ekaterinburg is very strongly ranked into zones (historical center, residential areas, etc.), so commercial real estate zones are marked. The analysis proposed in the study takes from two to three months of intensive research. The obtained results can be used as a base of averaged indicators for further analysis of the situation on the commercial real estate market. The development perspective for this study is to conduct a similar analysis after a certain period to derive the most detailed dynamics of the state of the commercial real estate market. At the moment, the study is a method of step-by-step analysis of the commercial real estate market, which can be used for a detailed study of the situation on the commercial real estate market in any city.

The authors plan to continue recording data to build the dynamics of indicators and further more detailed forecasting.

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